the Zentralanstalt für Meteorologie und Geodynamik of Vienna. It deals with the Tyrol and Vorarlberg, and has been prepared by Dr. H. v. Ficker with the cooperation, in the botanical and zoological part, of Prof. von Dalla Torre. The region under discussion is one of special interest by reason of the great contrasts which it presents. The North Tyrol is formed by the valley of the Inn and its tributaries. Here we have a long valley running east and west, and protected both to north and to south by high mountains. Föhn winds are frequent, and have a decided effect in raising the mean temperature. As a result many flora and fauna which are characteristic of more southern latitudes manage to persist. In the South Tyrol the main valleys, Etsch and Eisach, run from north to south. To the north they are protected by the central Alpine range, but to the south they are freely open to the plain of the Po. The Pustertal, running west to east, forms a region by itself. It is freely exposed to winds from the east, which have a decided influence in lowering the winter temperature. Finally, in Vorarlberg we have again a different arrangement. The valleys slope down to the north-west towards Lake Constance. This fact has an important influence on the climate, as the prevailing wind over this part of Europe is from north-west. The climatological data are discussed on the lines suggested by Hann in his "Lehrbuch der Klimatologie," which have been followed also in the previous volumes of the series. The peculiarities of each region are clearly set out and contrasted with one another.

The Scholar's Book of Travel. Part i., The British Isles and Readings in Physical Geography. Pp. viii+197. Part ii., Europe. Pp. viii+198. Part iii., Other Lands. Pp. viii+200. Part iv., The British Empire. Pp. viii+200. (London: George Philip and Son, Ltd., n.d.) Price 1*s.* 3*d.* each.

Cambridge County Geographies. Cambridgeshire. By Prof. T. McKenny Hughes, F.R.S., and Mary C. Hughes. Pp. xiii+271. (Cambridge: The University Press, 1909.) Price 1*s.* 6*d.*

THE teaching of geography in this country is undergoing a complete change. Efforts are being made in every direction to create interest in the human aspects of geography and also to render the study of the subject a training in the methods of science. The pupil is no longer merely set to learn by heart lists of geographical data, but he is encouraged by the study of maps, by simple experiments, and by reference to original sources, to discover and to arrange facts for himself, and by his own efforts to arrive at simple, broad geographical principles.

"The Scholar's Book of Travel" is designed to provide the young pupil with literary extracts from books of travel, and to give him the opportunity of learning from first hand accounts about this and other countries. The four little volumes should serve a distinctly useful purpose, especially as they will probably send the learner to the excellent books from which the extracts are taken. The majority of the excerpts are from the older writers—Livingstone, Speke, Mungo Park, Defoe, Kingsley, Darwin, to name a few—but the beauty and interest of the passages will doubtless make the reader desire to read the works of modern travellers.

The volume dealing with Cambridgeshire follows the general lines of the series to which it belongs, and these have been described on previous occasions. The authors provide an excellent account of an interesting county, and readers will find that though called geography the book gives particulars of the geology, history, antiquities, architecture, and the roll of honour of the district.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Fertilising Influence of Sunlight.

THE past history of agricultural science furnishes several examples of belated explanations of the utility of practices the value of which has long become a tradition among practical men. The explanation of the value of leguminous crops in agriculture is a good example. While the recognition of the *rôle* of these crops in increasing the nitrogen supply in the soil has done much to improve agriculture in new countries, it has only served to provide a scientific approval of the cultural practices of ancient civilisations, such as that of India, where from time immemorial it has been the custom to grow leguminous crops in the rotation and also as one of the constituents of the mixed crops cultivated in many parts of the country.

Agricultural science has recently provided another explanation of an ancient Indian practice. In the *Journal of Agricultural Science* of October last, Drs. Russell and Hutchinson have found that partial sterilisation of the soil by heating or by poisons leads to an increase in the supply of nitrogenous compounds and to increased fertility. These investigators state that partial sterilisation of the soil kills off the phagocytes which live on bacteria, and also large organisms inimical in other ways to bacteria. At the same time the soil bacteria are killed off, but the spores remain which germinate and rapidly multiply when the soil is moistened. The new bacterial cultures increase at an enormous rate, and the resulting nitrogenous plant food becomes so great that plant growth is greatly stimulated. The authors then go on to state (p. 120):—"There is reason to suppose therefore that the large destructive and competing organisms will be found of common occurrence in ordinary soils, checking the beneficial bacteria and limiting fertility. An important practical problem arises: is it possible to suppress them in ordinary field soils by any economical and practical process?"

The practice among many of the best cultivators in the Indo-Gangetic plain furnishes a most emphatic affirmative to the above question. It has been the practice of the ryots for centuries past to expose the alluvial soils of the plains of India to the intense heat and light of the Indian hot weather in April and May. The beneficial result on the succeeding crop is extraordinary, and has all the effect of a nitrogenous manuring. It is much more than probable that the result of this weathering is a partial sterilisation of the soil, and that Russell and Hutchinson's explanation is the correct one. Except in market-garden crops near the cities and in crops like sugar-cane and tobacco, manures are but little used in India. The growth of leguminous crops and the weathering of the soil during the hot season appear to be sufficient to keep up the fertility. More nitrogenous manure would no doubt be an advantage, but a great deal could be done by the cultivators themselves in weathering the soil during the hot weather in a more efficient manner than at present.

The extended use of cheap light iron soil-inverting ploughs during the hot, dry weather after the *rabi* harvest would do much to bring about a better exposure of the soil to the sun, and a more complete sterilisation. The wooden ploughs now in use are not adapted to open up the heavier lands unless they are moistened by rain, and in consequence a large area of the arable land is not ploughed at all until the monsoon. We consider one of the greatest improvements possible in Indian agriculture would be to impress on the ryot the value of weathering all arable lands in April and May to a much greater extent than is done at present. When iron has taken the place of wood in the ploughs of the Indo-Gangetic plain, it will be possible for the cultivator to take the fullest advantage of, and greatly extend, their present most admirable practice. In collaboration with Mr. H. M. Leake, economic botanist to the Government of the United Provinces, we have in progress a series of experiments in which the practical

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effect of weathering during the hot months on both the yield and quality of wheat is being ascertained.

A. Howard.
G. L. C. Howard.

Pusa, November 18, 1909.

A Note on the Gilded Metal-work of Chiriqui, Central America.

Among the minor ethnological problems which America offers in such variety, not the least interesting is that of the origin, significance, and method of production of the specimens of gold-work found so abundantly in certain parts of Central America and in the north-western regions of the southern continent.

The earliest European voyagers who reached the shores of the New World directed attention in their narratives to the gold ornaments and little images of "frogs, birds and men" found in the hands of the natives, and, as Humboldt urged long ago, arguing erroneously from the accumulated riches of generations of savages, they attributed great mineral wealth to the newly discovered lands, giving them such sounding names as Costa Rica and Castillo del Oro.

Articles of gold alloy are widely distributed throughout South America, and vary as greatly in artistic and technical execution as in the purity or baseness of the metal from which they have been fashioned. This metal-work has long been known to students, as well as to treasure-hunters, and is of so extraordinary a character that it at once attracts attention. Running riot, heedless of the proprieties, its motives include every variety of zoomorphic design—human, bestial, bird, fish, or reptile; all types of life are represented, together with monstrosities and ambiguous shapes bordering frankly on the diabolical.

A certain amount of South American metal-work finds its way every year to England through dealers who purchase it from natives and speculators who make it their business to explore the ancient burial places. Practically the whole of this is melted down on account of its intrinsic value, but it is comparatively seldom that objects of artistic or archæological interest are lost to science in this manner, by far the greater portion of the work being of the crudest description.

The present letter deals more particularly with the gilded metal-work of Chiriqui, on the southern boundary of Costa Rica, which presents features of peculiar interest. It has been studied carefully by Holmes, whose work on the subject, embodying references to the earlier literature dealing with it, is to be found in the report of the Bureau of Ethnology for the years 1884–5.

The immediate interest of the subject turns upon the occurrence of objects fashioned from copper-gold alloys of very variable composition, the latter metal being present in some instances in a proportion insufficient sensibly to alter the colour of the copper, whilst, nevertheless, the surface of the objects presents a burnished coating of fine and splendent gold. In many examples the film of precious metal is so slight that it has all the appearance of electroplated work, and many conjectures have been hazarded to explain the method by means of which the native artist produced the effect.

Holmes, in the treatise already cited, quotes, on the authority of Bollaert, a reference to the works of Acosta to the effect that the Indians of New Grenada gilded copper by rubbing it with the juices of certain herbs and afterwards subjected it to the action of fire, when it took the gold colour, but states that he had not been able to find the passage in question. The present writer has also searched the pages of Acosta in vain, but it is probable that Bollaert quoted from memory the following passage in the "History of the Indies" of Gonzalo Fernandez de Oviedo (Edit. Amador de los Rios, vol. iv., p. 189), where that writer says, freely to translate the paragraph:—"I would wish to say how the Indians [of the Antilles, and especially those of Hayti] know well how to gild the little things they make of copper, very yellow like gold. They have in this such skill and excellency, and give such a deep lustre to that which they gild that it seems to be good gold of 23 carats or more by its colour when it leaves their hands. This they do with certain herbs, and is such a great secret that whoever of the goldsmiths of Europe or of any other part shall find it out, he will be a very rich man, and that in a very short time if he uses this manner of gilding." The old historian of the Indies made efforts to learn from the Indians this secret process, but they excused themselves on the plea that the herbs made use of were unknown to them, and that the small quantity they possessed of them came from very distant countries.

"It is not impossible," says Holmes, "that an acid may have been applied which tended to destroy the copper of the alloy, leaving a deposit of gold upon the surface, which could afterwards be burnished down. . . . It is possible that the film of gold may in some cases be the result of simple decay on the part of the copper in the alloy . . . but the surface in such a case would not be burnished, whereas the surfaces of the specimens are all neatly polished."

The operation above mentioned, whereby the apparent quality of articles of gold alloy is improved by the artificial enrichment of the superficial layer, is one frequently practised among goldsmiths, who term it "colouring." A hot process, involving the use of fused salts, is generally made use of (*vide* T. K. Rose, "Metallurgy of Gold," edit. 1906, p. 19; W. T. Brantt, "Metallic Alloys," London, 1896; and Gee, "Goldsmith's Handbook," 1881).

Considering it probable that a germ of truth lay in the information given by the Indians to Oviedo, the writer made several experiments of a simple character to endeavour to clear up this point. It was found that by acting upon a base alloy with dilute nitric acid, a black lustrous film of gold could be readily obtained by removing in solution a portion of the copper. By heating the object thus treated out of contact with air, the black film of gold is annealed, changing to the yellow modification, and is left in a condition to be readily burnished with any suitable implement, for example, a water-worn pebble of quartz.

The mineral acids being, presumably, unknown to the craftsmen of pre-Colombian America, advantage was taken of the solubility of copper in organic acids in the presence of air, and after a few successful preliminary experiments with the pure chemical products, various acid plant juices, the "herbs" of Oviedo's Indians, were tried, and fully answered expectation. There can be little doubt that the Indians had no need to ransack "distant countries" for the wherewithal to gild their ornaments; but every craft has its mysteries.

It was found that among the various organic substances tried in the course of the experiments few effected the required reaction so readily as urine, which, with free access of air, rapidly covers the surface of the alloy with a coating of hydrated copper salt readily soluble in acid plant juice. When performed with the aid of these natural reagents, the operation is a very tedious one, the gold film, in the case of base alloys, taking months to acquire sufficient substance to admit of being burnished; but time signifies little to the savage.

In conclusion, although not desirous of affirming that the procedure described was that invariably followed by the Indians in the production of gilded work, the writer is decidedly of the opinion that their operations broadly followed the lines indicated in the present letter.

Oswald H. Evans.

"Arauco," South Harrow, February 1.

Suggested Common Day of Meeting for London Societies.

Will you permit me to make a suggestion regarding the days of meeting of learned societies in London? At present these days seem to be selected in a very arbitrary manner, with the result that the provincial members of the societies are often called to London on several days during the same week. For instance, last autumn I ought to have attended no fewer than four such meetings during the same week, namely, on Monday, Tuesday, Thursday, and Friday. It is, of course, impossible for the majority of provincial members of London societies to give up so many days—we are generally compelled in such circumstances to abandon all the meetings. By some curious law

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